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THE DIVISION OF INSECTS AND PLANTS

EVIDENCE

OF

DR. JAMES FLETCHER

ENTOMOLOGIST AND BOTANIST TO EXPERIMENTAL FARMS

BEFORE THE

SELECT STANDING COMMITTEE

ON

AGRICULTURE AND COLONIZATION

1905

PRINTED BY ORDER OF PARLIAMENT

As advance sheets of the Committee's Final Report

OTTAWA
PRINTED BY S. E. DAWSON, PRINTER TO THE KINGS MOST
EXCELLENT MAJESTY
1905

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DR. JAMES FLETCHER

THE DIVISION OF INSECTS AND PLANTS

COMMITTEE ROOM 62.
HOUSE OF COMMONS,
Friday, March 3, 1905.

The Select Standing Committee on Agriculture and Colonization met here this day at 10 a.m., Mr. Greenway, Chairman, presiding.

THE CHAIRMAN.—We will hear this morning from Dr. Fletcher.

DR. FLETCHER.—Mr. Chairman and gentlemen, as Entomologist and Botanist to the Dominion Experimental Farms it is my duty to make a special study of insects and plants together with their relations to the different industries of the Dominion. When invited to come before this committee, I thought it well in the first session of a new parliament, to give a concise statement of the work which has been done in the past and which is now being carried on in the Division of Entomology and Botany. To avoid misapprehension it may be well to state that although this important division of the work of the Department of Agriculture, has been under my direction since the Experimental Farms were organized and results of incalculable advantage have been secured, I have no hesitation in speaking freely of these good results for I maintain that every man who hopes to succeed must have a thorough belief in the utility of his work and in his own ability to carry it out. Moreover it is manifest that the work of such a division is not all done by the chief officer, and in speaking of the success of the division I do not refer to my own work any more than to that of my two energetic assistants who do just as much as I do myself. The work carried on is, I claim, of great use and I hope to persuade the members of the committee here present to-day that this is the case, and that it is worth their while to know a little more about it than perhaps may be the case at present.

SCOPE OF WORK IN THE DIVISION OF INSECTS AND PLANTS.

The different classes of work taken up, as the title of the division indicates, deal with insects and plants; particularly such as are injurious or the reverse. This includes a special study of all insects injurious to crops, but also of many beneficial species; of useful plants suitable for cultivation in Canada and also of noxious weeds, together with the best way of dealing with them. There are besides many cognate subjects which have demanded attention such as forestry, the reclamation of land from drifting sand or water encroachments, and investigations into the usefulness of various grasses and other fodder plants. The work has now been going on in its present form for eighteen years. Careful records are kept of all investigations, and gradually a large amount of valuable information has been accumulated which is at the disposal of the many correspondents who are constantly seeking information from the division.

CORRESPONDENCE AND COLLECTIONS.

Every year there is a large correspondence with farmers, which shows their appreciation of the fact that they can get useful information from the Experimental Farms. It may surprise this committee to hear that there is an average of over 3,000 letters every year written by farmers to this one division asking for advice about insects, plants, and other matters dealt with by the officers. With regard to the working machinery of the department, it is necessary, of course, to have good collections for reference, and efforts have been made to amass as complete collections of insects and plants as possible. The insects are arranged so as to show the injurious species in all their different stages, and in such a way that they can be easily examined. I have with me here (pointing to a case in front of him containing mounted specimens of insects) a sample drawer from one of our cabinets showing the way in which the collections are prepared for exhibition to visitors when they come to the office for information. From this the members of the committee will be able to judge for themselves how very useful these are in our work. In carrying out these investigations on injurious insects we try to discover as soon as possible the full life histories of all the different common insects which attack farm and orchard crops and in this way also complete our series of specimens for the cabinet.

In this drawer which I have here you will notice that there are divisions, each one of which illustrates the life history of a different insect. In the first section we have the well known pest of orchards and street shade trees, the Fall Webworm, which is shown by specimens of the male and female moths, the latter with a cluster of eggs which she has just laid on a leaf, the caterpillars of different ages, the nest in which they live on the trees, and the cocoons in which the chrysalis passes the winter. Similarly in other sections we find the Variegated Cutworm, which did so much harm on the Pacific coast three years ago, the Red-backed Cutworm, which is common and destructive all over the Dominion nearly every year; the Spotted Cutworm and the Black Army worm, the Zebra caterpillar, and two kinds of Tent caterpillars. In the left hand corner is the White Cabbage Butterfly, with some of the parasites which help to keep this destructive insect in check. The object of these collections is to help farmers to recognize their enemies when they come to the Experimental Farm, as many thousands do now every year, and visit the division to see the collections. It is very useful to them to know their enemies in all the different stages. A farmer looking at this case might not recognize the moth, the perfect form of a cutworm, but would probably be familiar with the appearance of the cutworm or caterpillar state of the insect which injures his crops. It is a frequent occurrence for farmers and others, when looking over the collections, to say 'Ah, that is the insect I want to know about.' It is therefore very important for us to have as complete collections as possible. I will draw your attention particularly to the skill that has been shown by one of my assistants, Mr. Gibson, in preparing these caterpillars and giving them the life-like appearance by which they may be so easily recognized. We have now gradually gathered together a representative collection showing nearly all of the worst enemies of crops in Canada. These are kept separately so that they may be recognized and so that the fullest information in regard to them may be given. At the same time, other investigations which do not show the amount of time devoted to them, are being carried on, and the results are all carefully recorded. That, too, is a feature of the work which I wish to draw special attention, to, that all work done is recorded so that it may be available for use when required, and sometimes it may be that the results of researches are held over for some years before the facts can be used. But when the time comes, as on some sudden outbreak of an injurious crop pest, the information is there, and complete life histories and popular statements as to the work of the insect, together with the best remedies, can at once be given to the public, either through bulletins, through reports of this committee, through the annual reports, or through what is probably the best way of reaching the country, the daily newspapers. The press has always shown the keenest interest in the work, and has made great use of the information which we have been able to give out from the Division of Insects and Plants.

ANTICIPATING OUTBREAKS OF PESTS.

Naturally no opportunity has been lost to keep in touch with work of the same nature which is being done in the United States and other countries. As a consequence we have been able on some occasions in the past to apprise the farmers of Canada beforehand of dangers with which they were threatened, and prepare them with advice as to the best steps to take when the enemy appeared. The Cattle Horn Fly was an example of this. An emergency bulletin was issued, giving the best remedies within a couple of days from the time it first appeared in Canada. The San José scale, one of the worst insects which has ever attacked fruit crops, was fully described a year before it came to Canada, and by this anticipation our farmers have been prepared beforehand to do the best that could be done under the circumstances to mitigate loss from the attacks of some of their worst enemies.

By Mr. Wilson:

Q. You might tell us what progress you have made in stopping the San José scale in the apple orchards of the Niagara district?

A. Excellent work has been done by spraying trees which were infested with the lime and sulphur wash; but, with your permission, Mr. Wilson, I will speak in detail of the San José scale later, if time permits. I want now merely to show that the work of the division is being actively prosecuted, and that the investigations are being pushed up close to the danger line.

Q. The only thing was I thought it was a very important matter, and we would like to know more about it.

A. I have a note to speak especially of it, sir. A working knowledge of the habits of the common crop pests may frequently effect a great saving for a farmer or fruit-grower. Such knowledge with regard to injurious insects is plainly of great importance on account of the enormous losses which these creatures cause. In almost all of our staple crops there is a reduction amounting to a very large percentage of loss every year due to injurious insects. No figures that I can give now would prove this, but the general statement may be made, and is a very low estimate, that at least ten per cent of every crop grown is destroyed by insects, and another tenth by fungous diseases such as smut, rust, mildew, &c. Any one who is especially interested in a certain crop and watches it closely throughout the season will know that a tenth is really, as an average, a very small estimate.

I have brought here to illustrate a matter which I wish to speak of emphatically to-day, some pease injured by the Pea Weevil. This insect for several years, up to last year in fact, destroyed at least $1,000,000 worth of our Canadian pea crop every year——

SAN JOSE SCALE.

A Member.—Tell us about the San José scale?

A. The San José scale is actually destroying orchards now in a small part of Canada, in the Niagara peninsula; that is in cases where fruit-growers are neglecting to spray with the lime and sulphur wash. I mention that it is only in a comparatively small area, because of the misapprehension which exists in some quarters with regard to the injury that is being done and the amount of infestation in Canada. If we read some of the English or United States newspapers we are led to believe that the whole of Canada is invaded, and that there is not a clean orchard or a safe nurseryman in the country. It might be well to state very positively that the number of nurseries in Canada which have ever been infested by the San José scale can be counted on the fingers of one hand. More than that, the statement might be added that everything that ought to be done is being done by our nurserymen, and there is no country in the world that is distributing better trees and cleaner trees than is the case with our Ontario nurserymen to-day.

The losses, then, are very great, and not only is this the case with injurious insects but it is also the case with some kinds of injurious vegetation. Fungous diseases every year destroy a large percentage of every crop that is grown, and many of these have been studied and remedies recommended for their control. A notable instance is the Potato Rot, which can be largely controlled by spraying with Bordeaux mixture.

NOXIOUS WEEDS.

Another subject which has aroused a great deal of attention is that of noxious weeds, and in most parts of our prairie provinces, which are a little more celebrated perhaps for the fertility of the soil than some others, this question has become one of enormous importance. It has received a great deal of attention not only from the provincial governments but also from the Federal government, and the Division of Entomology and Botany. By permission of the Honourable Minister of Agriculture, and at the request of the Manitoba, North-west and British Columbia governments, I have visited the West, and have held series of farmer's meetings to discuss weeds and their treatment for the last ten years.

RECLAIMING SAND-HILLS

There are other matters connected with the work which at first sight do not appear to be so important as those I have mentioned, but yet which have a very important bearing on those districts to which they are applicable. In the matter of forestry a great deal has been done by the experimental farms since they started, and one particular branch of that subject to which I should like to draw attention is the reclaiming of sand hills and sandy districts which, having been denuded of their trees, have become a danger to the districts surrounding them from the drifting of the sand. Important experiments are now being conducted at Lachute, Que., in replanting an extensive area of drifting sand. If this effort is successful, it will mean a great deal to the farmers living in the neighbourhood.

BUREAU OF INFORMATION.

I have merely touched upon the different lines of work we are doing; but from the mass of useful available information which has been gradually accumulated I claim that the Division of Entomology and Botany at the Experimental Farm is now a useful source of reference concerning insects and plants, with specialists in charge who are not only willing but most anxious to give the fullest information they can to the farmers of Canada. Further than that, the farmers of Canada have learned this and are making much use of the division. The more widely these facts are made known, to that extent will the division be of increasing use to the country. It is the desire of every member of the staff to make it as useful as possible. This end is attained by attending such meetings as this, from the freest criticism of our friends, which we invite, and by suggestions from those who are interested in the work.

Now, with regard to the different lines of work which have been taken up. It may be asked what has this division done which I am claiming is so useful to the farmers of Canada. In the first place, it has developed into a bureau of free information giving out regularly the latest results obtained in the warfare against injurious insects and parasitic plants; upon fodder crops of all kinds and their suitability for cultivation in the different parts of Canada; upon noxious weeds and the best way to eradicate them, and upon many other subjects connected with farming.

In connection with the introduction of Nature Study into the schools of the country, the services of the officers of the division have been made free use of by teachers and students in all parts of Canada, to help them in the identification of specimens of plants and insects.

DEFINITE INFORMATION GIVEN.

Perhaps I may now be allowed to refer to a few subjects upon which definite information has been given out as occasion arose to the great benefit of the community.

Spraying.—At the time the experimental farm system was organized the words 'spraying' and 'spraying pump' were actually unknown as the names of a method and implement for distributing liquids in a fine state of division, to protect plants against parasitic enemies. Largely through the work of the Division of Entomology the benefits of this work have been made known, and now every up-to-date fruit grower and farmer sprays regularly and saves much of his crop. I fully believe that the men who spray their crops regularly to control fungous diseases and insect enemies, can on an average double their crop by saving a loss of about 50 per cent which they would lose if they did nothing to prevent it.

Brome Grass.—When the Northwest was opened up for settlement it was soon evident that something would have to be introduced to take the place of the native prairie hay, and give heavier crops for the ever increasing herds of cattle. The Awnless Brome Grass, introduced by us from Russia, has met all requirements and is now cultivated on thousands of acres in the West, giving heavy crops of excellent hay and of readily marketable seed, while at the same time its cultivation very much improves the physical condition of the soil.

Potato Rot.—This destructive disease which probably destroys year after year about half the potato crop of the whole world, it has been found can be almost entirely controlled by spraying the potato vines, beginning about the first of August and following with four later sprayings at intervals of two weeks. A constant effort has been made to keep these facts before the farmers of Canada.

Standard Remedies.—From a continuous study of injurious insects, good standard remedies have been devised for some of the worst enemies of farm and garden crops. These have been arrived at after a great many experiments and we are now in a position to give a farmer definite information as to the best remedy for him to apply under his special circumstances. There are sometimes half a dozen different remedies which might be used with more or less success but if a man whose crop is being destroyed can be told to do one thing, he will generally attend to it at once, whereas if you give half a dozen remedies while he is making up his mind which to use, the crop may be destroyed. I will mention some of the leading insect enemies concerning which information can now be given at once.

The Codling Moth.—This is not a native insect but is now found in almost every part of the world where the apple is grown and everywhere is a destructive enemy, injuring a large proportion of the crop. Many experiments have shown that at least 75 per cent of the very best quality of fruit can be saved by spraying regularly and with the proper materials. Not only is this the case with the apple crop, but the plum cro pcan also be preserved from the attacks of the Plum Curculio to a rather smaller but almost equal extent, by spraying in the same way with standard remedies. By means of these standard general remedies most of the farmers and fruit-growers can do something when a new pest occurs, while they are waiting for advice from a specialist as to the way which his experience has shown is the best way to treat it. With your permission, sir, and with that of the committee, I purpose to submit a Spraying Calendar, as it is called, in which all these standard remedies will be printed in concise form for inclusion in your report, as was done a few years ago. This will save a great deal of repetition in the short time I have for addressing the committee to-day, and will be convenient for the members to give to their constituents or to find out for themselves what those who are specially connected with this work have found to be the best remedies.

I will now refer to some other pests which every year do a great deal of harm, which we have studied specially, and for which also we have made known as widely as possikble the best methods.

The Hessian Fly.—This insect has been a serious enemy of the wheat crop for a good many years, and the best remedies are pretty well known even if they are not followed. The practical information which is being spread broadcast through the country every year, reminding farmers in many instances of what they knew, but giving them, at the season of the year when it can be most useful, a definite statement which has been confirmed and corrected by others, as to the best measures to adopt, is of use in persuading them to use methods by which loss can be abated. In the treatment of the Hessian Fly it was recommended first of all to sow the seed later, so that the young plants might appear above the ground at a time in the year when the females which lay the eggs had disappeared. All insects have their exact season in the year for appearing, and in the same way that an apple tree blooms at a certain time of the year and the fruit is ripe at another time, so we find the same rule is applicable to insects. They appear at a certain time in the year, and only at that time. There is, however, a certain difference, in that there may be one, two or even threeb, broods of any certain insect in a year; but they all have their regular times of appearing. The question is to find out when that time comes and if it is possible to change our agricultural methods so that a crop is presented to its enemies in such a condition that it cannot be injured, the main end is attained of protecting the crop. By sowing fall wheat at the end of September, instead of what is certainly the best time under all favourable conditions, in the beginning of the month or at the end of August, the young plants appear above the ground after the time when the Hessian Fly has disappeared, so of course no eggs can be laid. In addition to that there are other remedies, but they are secondary, late sowing is the chief remedy. The burning of the straw after threshing, cutting high and burning over the stubble, the destruction of the screenings and the application of a special fertilizer in spring, all have to be considered according to circumstances by practical farmers who keep well in touch with what is going on.

Cutworms.—With regard to cutworms, it may be mentioned that the word cutworm is a general name applied to a whole class of caterpillars such as you see here, which every year do a great deal of harm in the spring time. Each has its own habits and all have a special time at which they appear and attain full growth. A knowledge of these facts is sometimes of the utmost importance when deciding upon a remedy. It has even been found sometimes that doing nothing at all is the best remedy, that it is the best paying remedy.

During last summer a farmer in the province of Quebec wrote to me complaining about a kind of cutworm which was eating down his peas, and asked what he could do to save them. He received the rather surprising information that his best course was to do nothing at all, that the caterpillars were full grown and would soon disappear, and that he would still get his crop all right and without any expense for special treatment. Some years ago we had upon the experimental farm here an experience almost identical with this farmer's. Three acres of peas were eaten bare before the caterpillars could be checked, and as the pea plants were entirely eaten off we supposed that there would be no crop; but as a matter of fact both on our field and on this farm in Quebec a heavy crop of peas was reaped, and no difference could be noticed between the part of the field where the plants had been eaten off and where they had not. Now if we had not had experience beforehand we could not have given our correspondent advice so confidently when he asked for information, and he would have ploughed up the land and lost all his peas, which he must have wanted, or of course he would not have sown them, and besides this he would have been put to the expense of sowing another crop.

By Mr. Lewis :

Q. Is there not a danger of the crop being injured afterwards by a second brood of those caterpillars ?

A. No, there is only one brood in the year of the Black Army worm, the kind referred to, and, when that is disposed of, there is no more danger. The caterpillars only occur in the spring and reach full growth by the end of May. There are in North America about 300 different kinds of moths which lay eggs from which the caterpillars called Cutworms come. Many of these we have been able to study and to learn their habits as to the time the eggs are laid, when they hatch, and the length of the caterpillar life; also the kind of locality or soil in which they are most likely to occur. After trying many remedies we have found that the so-called Poisoned Bran Mash is the most effective. This is simply a mixture of bran or shorts and Paris green, and not only is this remedy applicable in gardens, but it is just as useful in field practice. The mixture is composed of one-half pound of Paris green and 50 pounds of bran. That is a very large quantity of bran, but the quantity of Paris green mentioned is sufficient, and the mixture is distributed over the fields either by hand or with a flat instrument, such as a paddle or piece of shingle by which the material can be thrown 20 to 30 feet. The remarkable fact that has been brought out by experience is that cutworms will eat the mixture actually in preference to green vegetation. No remedy which we have ever tried has given us such decisive results as this. The persistent recommendation of this remedy has resulted in a great saving to the farmers and the gardeners of Canada, and any one who has ever tried it has recognized its utility, and it is now being used over a very large area. There is another class of cutworms called climbing cutworms; these come out at night and crawl up the trunks and attack the foliage of apple and other trees. When their presence is noticed they may be poisoned in the same way by placing some poisoned bran around the bases of the trees, or may be kept from climbing up by tying a band of cotton batting around the trunk. There are other and more permanent forms of tree protectors, but cotton batting as a rule answers for the short time it is required.

By Mr. Herron :

Q. What quantity of land would that mixture of 50 pounds of bran cover ?

A. Considerably more than an acre, because you would not require to put it over the whole area. You can see by the appearance of the crop where it is necessary to distribute it, but if the whole acre were infested it could be cleared very easily with the quantity mentioned.

By Mr. McLennan :

Q. Would you moisten the mixture before application?

A. Yes, slightly. The method of mixing it is given concisely in my last report. Dampening the bran slightly with water having a little sugar dissolved in it causes the Paris green or other poison to adhere to it. After mixing thoroughly add the Paris green little by little, stirring all the time. If Paris green is added to the bran when it is perfectly dry, it will, owing to its weight, sink at once to the bottom when stirred. Half a pound of paris green is sufficient to poison 50 lbs. of bran, although double this amount may be used. Bran should be added to the mixture until it will crumble easily and run through the fingers without adhering. It may then be distributed through or along the edge of an infested crop or may be applied to land either around or between plants, or a row may be run close to drills by means of a Planet Jr. seeder, or a similar implement. For such crops as tomatoes, cabbages, tobacco, &c., a collar of paper put around the stem at the time of planting will prevent the destruction of many plants. Seedlings must be transplanted so that none of the leaves hang down and touch the ground. The same protection is provided in a more permanent manner, but at greater cost, with strips of tin. Convenient rings may be made from old tomato and fruit cans by throwing these into a bonfire and melting off the tops and bottoms and then splitting the sheet of tin which is left down the centre. This not only makes a good protection against cutworms, but disposes of a class of rubbish which often accumulates to an inconvenient degree.

Apple Aphis.—Another instance came before my notice where this laisser faire policy was the best. It was when the Apple Aphis, an insect which attacks the apple tree just as the buds are bursting. In this part of Canada it seldom pays to use any remedy for the apple Aphis in the Spring, and the only instance in this part of Canada where the aphis occurs injuriously and where it pays to treat it, are when it attacks nursery stock in nurseries. Then, however, nurserymen can control it at the time when it is most abundant and in the month of August, but the use of the well-known remedies for sucking insects such as kerosene emulsion, or whale oil soap solution, which are to be applied as sprays, or when more convenient the heads of the young trees may be dipped into a receptacle filled with one of these, or some other similar remedy.

Grasshoppers.—A remedy which has been exploited by the division and which has given excellent results, is that which is made by mixing Paris green with fresh horse droppings as a practical remedy against grasshoppers. This has proved especially effective for destroying grasshoppers or locusts, as they are generally called. For a period of four or five years recently grasshoppers did serious harm in Manitoba and in parts of the North-west and British Columbia. Many expensive machines and implements have been manufactured for destroying them, such as the hopper dosers and other expensive methods. But of all the methods a Canadian remedy, which was discovered by Mr. Norman Criddle, of Aweme, Manitoba, has given the best results. Mr. Criddle, who is an observant farmer, living in Central Manitoba, noticed that wherever horse droppings were lying along the trails, the grasshoppers gathered around them in great numbers. Bran is very expensive in the West, and it is also troublesome to get. Therefore, the observation that this material, which can be obtained on every farm, was so effective as an attractive bait, was of great importance, because it costs nothing, and for that very reason was more likely to be used than anything which had to be purchased. The formula is, horse droppings 100 parts, moistened sufficiently with salt and water (1 lb. in 2 gallons), so as to be easily distributed, and one part of Paris green, were mixed together. This material was put in a half barrel, placed on a stone boat, and was drawn around the edges of the field and scattered broadcast through the grain; the material was distributed easily by means of a flat paddle or shovel. This remedy at first was hather jeered at by those people who didn't take the trouble to try it, but those who did try it saved their crops, while the jeering neighbours lost theirs. The practical result to the general public was that we now have a good, cheap and effective remedy for one of the worst enemies the farmers in the West are liable to be visited by. In fact, it is the best remedy for locusts which has been as yet devised, and those farmers who have used it in very bad years have been successful in saving their crops. The chairman himself, who is here to-day, and every one else in Manitoba, knows very well the excellent work which was done by his department in Manitoba a year or two ago, in making this remedy known, and he also knows that it has been successful in saving many crops all through the country where locusts occurred, so that in some districts where the pests were abundant and committed great damage a few years ago, they have now practically disappeared. I do not claim that this remedy alone has stamped them out, but it has certainly reduced their numbers enormously. It is not claimed for any remedy, at least not by reasonable people, that it will give perfect results. No doctor will claim that he can save every patient he treats, nor do we claim that these remedies which we suggest for injurious insects will save all the crops entirely and at once. All that is claimed is that the remedies recommended will give sufficient relief to make it pay farmers to use them to protect their crops, and we see to it that the remedies we recommend are the most practical ones known. In spraying for the different orchard pests we do not claim that we can save the whole crop, although this is sometimes the case; but we do claim that by spraying as recommended any fruit-grower can save 75 per cent of his crop from injury, and that this large proportion will be of the very best quality, while if he does not spray he may lose his crop altogether or a very large portion of it will be injured by insects and fungous diseases like the Black Spot of the apple or the Cracking of Pears.

By Mr. Lewis :

Q. It might be advisable that people should know why it is best to put this horse dung mixture around the outside of the fields. Is it to prevent the grasshopper flying over and getting to the centre?

A. Yes, they almost always come from stubble fields to attack growing crops. The habits of the grasshoppers have been very thoroughly studied, and it has been found that they lay their eggs by preference in certain kinds of soil or where the land is in a certain condition; the most favourable condition is presented in a field at the time it has a crop of grain growing on it. Now, the time these insects do most harm is not when they can fly and are laying their eggs; but it is on the new crop the next year by the young insects which have hatched in the old stubble fields. It is in the firm soil of fields under crop that the conditions are presented which are most attractive to the female grasshoppers for laying their eggs. It has been observed that the females will congregate or cultivated fields to lay their eggs. You will not find a pod of eggs in the grass on the unbroken prairie; but you will find them by the hundreds in the cropped land. The mature grasshoppers die before winter sets in, and the only way in which the insects pass the winter is in the egg state in the soil. Therefore, in the spring the eggs are in the stubble where the young grasshoppers hatch, and then migrate from those fields to the growing crop. The recognized remedies are the ploughing down of the stubble before the eggs hatch or before the young hoppers are large enough to do damage to the growing crop; or if this has been neglected the treatment of the growing crop with such remedies as I have mentioned, before the young locusts have had time to destroy it.

By Mr. Wilson :

Q. Ploughing down, I presume, would be the better remedy?

A. The better remedy by far, because where the grasshoppers do most harm is right in those dry districts where experiments have shown that summer-fallowing every other year is the best means of securing a heavy crop of wheat, and the ploughing down of stubble early, so as to kill the young grasshoppers, is the first operation in getting a good summer-fallow. Summer-fallowing in many parts of the west is begun too late. The question of summer-fallowing in the west, of course, is largely one of retaining moisture, and the frequency with which the operation is practiced must be decided according to the district, by the farmer who is using the land. In the hot, dry districts of the interior such as Moosejaw and Indian Head, summer-fallowing to give the best results should be done every other year. Further east, once in three years, as a rule. In the rich Red River valley some do not believe in summer-fallowing at all. They have moisture enough and must use other methods for cleaning their land of weeds. The question was asked here of Dr. Saunders the other day in comparing districts in the west, whether Indian Head was not an exceedingly rich district. It is exceedingly rich, and with proper treatment the land gives grand crops, but it must be remembered that it did not do so 20 years ago. The methods of farming have changed, and Indian Head is to-day one of the best districts of the North-west Territories, only because the farmers have learned how to work those good lands; namely, to summer-fallow regularly to hold in the moisture necessary to give big crops. When the experimental farm was established there the government was criticised severely for buying land which it was said was not of any use, because it was too far west, was too dry and was out of the wheat belt; but by Mr. McKay persistently dinning into the farmers of that district the absolute necessity of summer-fallowing properly, its great fertility has been proved. He told them that they should break the land early while still moist, then harrow at once and follow by two or three cultivations of the surface before winter, so as to destroy weeds, and they would thus hold sufficient moisture in the land to produce good crops the next year.

By Mr. Maclaren:

Q. How long have you had that farm?

A. Seventeen years, I think.

By Mr. Lewis:

Q. What I was trying to get at was the use of this mixture to kill grasshoppers. You put it around the edge of the field in order to prevent the grasshoppers flying over?

A. Yes. It is so attractive to them that they stop there and feed and it kills them. After they have eaaten some of it they have been found lying dead, by actual measurement, 100 feet away in the field. The best time to treat them is when they are young and have no wings when they hop from the stubble fields to the green growing crops. They are then so numerous as to attract everybody's attention, numerous enough to injure the crops very quickly and the farmer who sees them on his land should apply the remedy promptly. If he allows them to spread through his crop a considerable amount of injury is done, and although he may save some of his crop, early work pays by far the best. The grasshoppers become fully grown and can fly by the middle of July, but before that time, where the edges of the fields have been treated, the grasshoppers are killed and greatly reduced in numbers. I mentioned the edges of the crop because the best work has been done by simply treating the edges of the crop. It is unwise to drive to or walk out into the crop and apply any remedy because of the injury done in walking over the grain. The crops in the district around Douglas were much injured a few years ago and I saw there a striking object lesson. There were two wheat fields close together, one of which had been treated with the criddle mixture, but the other had not. One field gave 18 bushels per acre and the other none at all. It was eaten as bare as this table.

By Mr. Cash:

Q. Does not the grasshopper do most of the damage before it is developed?

A. Yes. When they are large they fly great distances at the time they migrate, and their chief business is breeding. They leave the fields where they have developed and fly to others. When they attack fields in spring they are found on the edges of the crop because they come there from the stubble fields. They can be treated easier while there because they swarm on the succulent young crop, devouring it and this reduces the labour very much, an important point.

TURNIP FLEA-BEETLE.

A member of the committee asked the question whether there was any treatment for the turnip flea-beetle, and suggested that sowing late was a good remedy. This undoubtedly is the best agricultural remedy that can be adopted, and in hot sandy districts or where injury takes place every year it is wise to delay sowing the turnips till about the 20th of June, as an average date. At Ottawa that is the exact date. This allows the young turnips to come up after the first brood of turnip flea-beetles has disappeared, and when the second has not yet arrived. The injury to turnips is so severe because then the plant is very young the beetles attack the seed leaves. These are not true leaves although they are green, but are really small bags filled with food for the young plant to serve it until it has formed its rough or true leaves. Any injury, therefore, to the seed leaves is a serious loss to the young plant. That is why injury to seed peas by the pea weevil is so serious. The habit of growth, however, is not quite the same in these two plants. When a young pea plant comes out of its seed the seed-leaves do not come to the surface, but in the young turnip plant the two seed-leaves are pushed out into the air and act as reservoirs of prepared food to feed the young plant until the true leaves are formed. Any injury to these is very severe, because the young plant has no means of living when they are cut off. If you take a seed of some plant which has a large seed like a bean, for instance, or a squash, which can be examined easily and allow it to grow and then when the seed-leaves have expanded you cut them off, the plant will die. It cannot take food from the air because it has no leaves, and it cannot get much besides water from the soil, which alone will not support it.

By Mr. Cochrane:

Q. Have you ever tried experiments with artificial manure on the drills to force rapid growth?

A. Yes, that is avery good plan, but if the beetles are so numerous that they injure the leaves before the shoot is formed the plant must die.

There are three remedies for the turnip flea-beetle. First, and most important, is sowing late, because turnips are a crop which can be sown late without loss. In saying this it may appear that I am rather conflicting with what Dr. Saunders said the other day about the benefit of early sowing, but he only spoke of the larger weight per acre obtained by early sowing. By sowing late you get a smaller weight, but better turnip. If you can sow late and get 10 tons it is better than sowing early and getting your crop largely destroyed by insects. By sowing late we miss the first brood of the turnip flea-beetles, which pass the winter as beetles and appear early in spring. Another remedy is to dust a poisonous mixture over the young plants when they first come up. In this way we can protect them for two or three days, during which they produce the small central tuft of rough leaves. We have had excellent results by dusting the young plants with a perfectly dry mixture made of 50 pounds of land plaster, or any other perfectly dry powder, and one pound of Paris green mixed thoroughly together.

Q. Did you ever use dry salt with land plaster?

A. No, not with land plaster. Salt has very little effect on injurious insects. It might possibly help the plants.

Q. It has a tendency to retain the moisture?

A. I have no doubt that may be the case, but I have never tried, and I do not know that. Salt is very useful on many field crops, as barley, and I have no doubt that if the turnip plant would stand it, it might be very useful.

Q. I put it on the surface before the seed is put in?

A. To keep the ground moist.

Q. It forces the plant up very rapidly?

A. I think it might be very useful when the seed was sown late because the weather is sometimes very hot in June.

By Mr. Bland:

Q. Would that prevent the insect on the turnip plant later in the season when near maturity—the turnip louse?

A. No, that is an insect with quite different habits.

Q. I have noticed in my country that you can sometimes hardly see the turnips for inssects when they are sown early?

A. That means, I think, that the late sown turnips if they get a good start have more power to throw off the insect attack. The *Turnip Aphis* is very conspicious sometimes in a field on high knolls or where the plants are near a tree growing in the field. This is because the tree for some distance all around it dwarfs the turnips by robbing them of moisture and the plants being weaker are more attractive to the insects. A vigorous plant outgrows and throws off the attacks of insects and in all methods of prevention of insect attack such circumstances show us the necessity of trying to produce a vigorous plant and of pushing on a rapid healthy growth.

By Mr. Cash:

Q. Would that be the same louse that attacked the wheat in the Northwest this year? They were so numerous that they stopped the binder?

A. No, but it looks a good deal like it. I saw one or two instances where the *grain aphis* was very abundant in the West last year. It is a different insect. The insect that injures turnips merely attacks the turnips, the cabbage and plants of that family, but its habits are very similar to those of the *grain aphis*. I do not know that the injury to the grain crop was very severe this year, because the insect appeared so late that it did not do so much harm as was anticipated by some who saw it. However, there was a certain amount of shrivelling of the grain due to the plant lice having sucked the sap from the ears of wheat while the grains were soft and forming.

By Mr. Cochrane:

Q. In reference to the early and late growing of turnips have they ever been analysed to ascertain the difference in feeding qualities?

A. I believe they have, and some of our superintendents have very decided opinions about the value of small turnips, which they deem perferable to large ones, but I think Mr. Shutt has been working on this subject and will probably give you the information if asked when he appears before the committee.

Q. I mean between the early and late sowings?

A. I think Mr. Shutt will give you the result of analyses which I believe he has made.

By the Chairman:

Q. In speaking of the dates of sowing you were referring to the dates for Ottawa when you mentioned the 20th of June?

A. Yes; the date mentioned, the 20th of June, was for Ottawa.

Q. That will answer for all Ontario?

Q. Well, probably a little earlier for Western Ontario.

By Mr. Bland:

Q. I know that we used to consider we would have to get them in early, in order to get the hoeing done before haying came on or they would be a failure. Our turnips have been a failure that have been sown early of late years, and I think our own seedsmen have said that from the 16th to the 24th June was the best time in Western Ontario?

A. That would practically be the date. Your season at that time of the year is a little earlier than ours.

Q. We have adopted that plan, and invariably we have benefited by it?

A. You avoid the attacks of the flea-beetles in that way.

Q. Yes, and get moisture enough to get the seed started?

A. Although I said on the 20th of June for this locality, experience would have to show the exact date for different districts; the 20th of June is the date for Ottawa. I should not suppose, however, there would be very much difference over the whole of Ontario and Quebec down to New Brunswick, merely a day or two.

THE RUSTS OF GRAIN.

By Mr. Schaffner:

Q. I do not know whether it is pertinent to this subject this morning or not, but have you any opinions on rust that affected us so much in Manitoba last year?

A. Yes, sir, you will find a rather complete article upon it in my annual report now in the press. My opinion is, after considering all the circumstances, that you will not have very much trouble with rust in the future. In the whole history of the country we have never heard of such an outbreak of rust as you had this year, and I do not think it is in the least likely you will have another unless some very decided change in the conditions which generally prevail takes place.

Q. What is the difference between the kinds of rust, the black rust and the others?

A. There are several kinds of rust, parasitic on grain crops, which have to be dealt with: the Orange and Leaf-rusts that appears early in the season and the Black Stem rust which appears later on the straw. The Orange and Leaf-rust does not do very much harm to the crop, as it develops chiefly on the leaves, but the Black Stem-rust does a very great deal of harm because it develops on the stem and intercepts and uses up the food material on its way to be stored up in the forming grain. Of course both kinds do harm, but the injury by the leaf rust is very much like one man stealing from another without his knowing it. While in the case of the Black Stem-rust it is like a man taking the food off one's fork just as it is being put into his mouth—it stops the food going to the grain just at the time when it is needed.

Q. What are the circumstances that make you think it will not come this year?

A. Judging from the fact that we have no record of any such outbreak in the past. The weather conditions of the season affect very largely the prevalence of the different fungeous. We now have records of at any rate 30 years of the West as a grain growing district and there never has been such an outbreak as we had last season. Fungous diseases of plants, the same as the epidemics among animals, are exceedingly prevalent and destructive at some times, and then disappear almost entirely for a long time

Q. If there is a similar season to what it was last year we will have it again, will we not?

A. You may or you may not; there are two things to consider: the presence of the spores and conditions favourable for their growth. The rust is a plant, minute as it is, and has its seeds or spores like any other plant, and given the same conditions that you had last year, with the spores there, you may have injury again, but I think it is unlikely.

By Mr. Cochrane:

Q. Will salt do anything to kill the germs? I had an experience with the black rust I had a summer-fallow and a part of the field was composed of new land and I intended to use the old land because I thought it would help it, but my men got part of the way across the new piece before I got up there. I stopped them there and when we came to cut the grain there was black rust on part. Where we used the salt it was not in any way as bad. It was almost free from rust. It appeared to be free owing to the use of salt?

A. Undoubtedly the salt would have some effect. We know that salt has an effect on all vegetation, either deleteriously or beneficially, and your experience would indicate that it would have a beneficial effect by preventing the rust fungus from developing. I thought at first when you spoke that you said 'stock' instead of 'salt,' and that suggested another thought to my mind. There is no doubt that the feeding of rusted straw may have the result of spreading the rust disease. The fungus passes the winter in the straw in a resting condition; it is a parasitic plant. Now, if rusted straw is fed to stock the fungus will keep on growing in the manure, so that treatment of the manure to destroy the fungus is necessary, or at any rate desirable. It is possible that turning it frequently might be beneficial. Whether that will have the effect of destroying rust we do not know, but it would do no harm to turn manure from animals fed on rusted straw very thoroughly before putting it on the fields. A rather interesting result came out of the analytical experiments by Mr. Shutt which he will probably present to you when he appears before the committee, but I will mention it briefly as it has been published in the newspapers. It was found that straw from a rusted crop is actually richer by far in feeding value than clean straw. That is explained by the fact that the rusted straw has held in its tissue much of the food material that should have gone to the berry, but was arrested by the parasitic rust.

By Mr. Blain:

Q. Is rust due to climatic conditions?

A. The increase of rust is due to climatic conditions, but it cannot be said that they cause rust, but they do favour its propagation and increase. Rust is a plant which must originate from a spore or seed.

Q. I know that last year we were troubled with the rust in our fall wheat. I had considerable fall wheat, some of it on new land, and I believe that was the worst in the neighbourhood?

A. The abundance of the disease would undoubtedly be from climatic conditions. The rust plant has a curious growth; the spores which pass the winter in the straw, germinate in the spring in the old straw or stubble left on the field. That is their first spring growth, and after a short time they produce other spores which are exceedingly light and which are carried by every lightest draught of air that moves. When there is the slightest movement of the air these spores are carried far and wide for many miles, or even hundreds of miles, until they fall upon a suitable host plant when they germinate there, and from these spores the next condition of the plant grows and that is the one that penetrates the tissues of the wheat plant and does injury to the crop. A crop 100 miles from another infested crop may be easily infested by the spores which are carried by the winds.

By Mr. Cochrane:

Q. How do you account for the fact that it is always worst in our section of the country where the crops are very heavy?

A. That is because there is less air moving among the plants; there is no chance of ventilation by the air blowing through the crop. The rust may develop under such conditions, but if the conditions are made unfavourable for its propagation by dry air blowing through it it may dry up and be made ineffective in the same way that even such a terrible disease as tuberculosis may, under certain conditions, dry up after it has reached a certain stage and the patient overcome it.

By Mr. Blain:

Q. In what parts of Canada is the rust most prevalent?

A. In Ontario and the provinces to the east.

Q. Is there any part where you have not found rust?

A. In the hot dry districts of the prairie province and British Columbia it is almost unknown and is very rare in Manitoba in the dry districts.

By Mr. Shaffner:

Q. From your theory it appears to me that on the high knolls wheat would be affected most and that there would be less rust in the low districts according to your theory?

A. If the development of the plant was less vigorous it might suffer—the knolls in the fields might be unfavourable to the development of the wheat plant which would then be more liable to attack.

By Mr. Worthington:

Q. Is this new article that is being used, gypsum, of any value? Have you had any experience with it?

A. Gypsum can hardly be called a new article. It is used as a quick acting—not fertilizer exactly, but encourager of growth on certain soils. It releases the plant food in the soil and makes it available for the uses of the plant.

Q. Is that beneficial to the manure?

A. Well, I think it is not mixed with manure. It is used in stables for collecting ammonia and preventing unpleasant odours. It is not put with manure as a rule; it is used separately.

Q. It is used in the stables as a collector of nitrogen?

A. Yes. Mr. Shutt will explain that to you. It has been used for a great many years in Canada, especially in those districts where it can be easily obtained.

POTATO ROT.

Speaking of fungous disease, I should like to refer to the good work which has been done by the Division with regard to the potato rot. This disease destroys every year an enormous proportion of the potato crop of the whole world. The results of experiments carried on from year to year, every since the farm started, show that loss may be almost entirely prevented by a cheap and easy remedy, which consists in spraying the tops of the potatoes during growth, about the first of August in this district, with the Bordeaux mixture, composed of copper sulphate with lime or soda to neutralize its injurious effects. This prevents the propagation of the disease and the consequent destruction of the tubers almost entirely.

By Mr. Maclaren:

Q. What date do you spray them?

A. For Ontario, about the 1st of August, when they are about a foot high.

Q. How does that affect the potato bugs?

A. They can be killed at the same time by mixing Paris green with it. The Bordeaux mixture alone is not sufficient to destroy the potato bugs, but by adding Paris green the beetles are destroyed at the same time as the potato rot is prevented.

Q. The same mixture that would do for fruit trees?

A. Yes, practically the same mixture, but rather a larger proportion of copper sulphate can be used on the potato plant. For use on fruit trees, four pounds of sulphate of copper, four of lime and four ounces of poison; on potatoes, six pounds of sulphate of copper, four of lime and the same amount of poison. Potatoes will stand a stronger mixture without injury than fruit trees will.

By Mr. Cochrane:

Q. How much water do you use?

A. Forty gallons.

By Mr. Lewis:

Q. Before you leave this question, would the rot in potatoes or in corn stalks if fed to cattle be injurious to them?

A. They would not eat many of the rotten potatoes, and experiments have not shown that there is any injury to stock from eating mildewed straw, if they would eat it. Some experiments tried with corn smut did no harm to the animals, but they soon became nauseated and would not eat it.

By Mr. Maclaren:

Q. How much Paris green do you consider necessary?

A. As a general recommendation for spraying fruit trees, one ounce for every 10 gallons of water—that is, one pound for 160 gallons. It is best when using Paris green on foliage always to add an equal amount of fresh lime.

Q. Do you ever use arsenic alone?

A. I have used arsenate of lead; arsenic alone is too dangerous.

Q. Arsenic is used very largely by the large fruit growers?

A. That is because it is cheaper, but I think the cheapness is not of sufficient consideration to make it worth the risk of using it. Serious injury to foliage by using arsenic is very common. Paris green is comparatively cheap and gives constant results which are as good, if not better. There are other proprietary preparations as Disparine, Green Arsenoid, &c., which are also useful. The green colour of Paris green is a great advantage as it prevents it being mistaken for any other material used about a house.

By Mr. Ingram:

Q. Speaking of this rusty straw that would be profitable for cattle, would that affect milch cows?

A. No, I do not think it would. What I said was that it is richer in feed value. I would not like to recommend it being used in a district where there was rust on the crop, unless it were absolutely necessary, because there would be a possibility of the rust fungus being increased and propagated through the manure.

By Mr. MacLaren:

Q. *Horn Fly.*—Have you anything to prevent the fly from bothering cows at fly time?

A. We have found the best remedy for the cattle horn fly is a mixture of one pound of pine tar in five of lard, tanner's oil or other grease.

Q. How do you apply it?

A. It is put on with a rag or brush on the shoulders, the back or such parts of the animal as the flies congregate upon.

PEA WEEVIL.

I began to speak of the Pea Weevil and should like to say more about it. The loss from the Pea Weevil during the last ten years will probably average $1,000,000 year. Now, I claim that from the peculiar nature of this insect there is no reason why it should not be wiped out absolutely from Canada and from North America, and, therefore, it is worth while for everyone to know obout the insect and its habits. In this way it may be possible to get the remedy applied. First of all, it is an introduced insect. It has no other known food plant than the seed of the cultivated pea. The cultivated pea cannot withstand the cold of our winters and all seeds left in the field the year before are destroyed before the growing season the next year. There is no such thing, I think, as a volunteer crop of peas. This is important because every pea that is sown has been within the control of somebody during the winter, and we have a positive and effective remedy, namely fumigating with bisulphide of carbon, by which every weevil in seed peas can be destroyed during the winter or before the seed is sown. The farmers have it in their own hands, and I want to draw special attention to this matter now. If I could only induce everyone to refuse to buy seed peas without a guarantee from their seedsman that they had been treated to destroy the weevil and also get those who save their own seed also to treat it before sowing—this injurious insect could be stamped out. When a farmer wants peas for sowing he should refuse to pay the seedsmen full price for peas that have not been fumigated or treated to prevent the weevil. The peas as seed are only worth about one-sixth as much as uninjured seed, and when forced to do so seedsmen have fumigated peas in the past and have sold clean peas. In 1904 the Pea Weevil almost disappeared. Now, therefore, is the time for everyone to make a most strenuous effort to wipe it out altogether. The injury in 1902 was very great, not quite so much in 1903 and very little in 1904. As a consequence of this many farmers will sow peas this year who last season refrained from doing so.

By Mr. Cochrane:

Q. How do you account for that reduction?

A. I cannot altogether account for it. I claim that farmers following advice given them by specialists had something to do with it, but the weather had also a great deal—the intense cold of last winter and the cool summer did much to reduce the numbers of this pest. But that is not the point now. The point is this, the Pea Weevil is perhaps at a lower ebb in occurence just now than has been the case for many years. Further, owing to the cool season I believe that very few left the peas last autumn, so they are now in the seed where we can get at them, and if everybody would only make a great effort this spring not to sow peas unless treated, the Pea Weevil could be reduced enormously.

By Mr. MacLaren:

Q. Wouldn't it be a good idea to add that to the Seed Bill?

A. Legislation on agricultural matters has always been a rather doubtful policy.

Q. We have a very doubtful bill then?

A. No, it is a pretty good bill. You don't know what good that bill has done, Mr. Maclaren. The very fact of discussing the matter has induced seedsmen to supply cleaner seed than has ever previously been the case in the history of this country.

By Mr. Cochrane:

Q. Would you allow me to ask this question: In our section of the country we have not sown any peas for three or four years. We would be, I suppose, pretty safe in sowing them this year, that is as far as the pea bug is concerned?

A. A little safer, that is all. The Pea Weevil beetles can fly long distances.

Q. You think that if there is no seed used which has not been fumigated it will help us?

A. Certainly, it is very much better to kill the weevil in the seed before sowing. If you kill it it cannot do you any harm.

Q. Can any farmer apply that remedy himself?

A. Yes, any farmer can fumigate his own seed quite easily. The material used, bi-sulphide of carbon, is cheap and easily procured. Any farmer can get a coal oil barrel which will hold 300 lbs. or 5 bushels of peas. Three ounces of bi-sulphide of carbon put in a saucer on the top of the peas, or even the liquid poured right on to them, and then a tight cover placed over the barrel to keep the fumes in, will kill every weevil in the seeds. The barrel must be kept tightly closed for 48 hours, and as this liquid is very inflammable, care must be taken not to bring a light of any kind near. The work is best done in an open shed out of doors.

By Mr. Henderson:

Q. But will it kill the seeds as well?

A. No, it will not injure the peas at all and the beauty of this remedy is that ten minutes after the cover has been taken off the seed will be fit for use should it be necessary to use some of them for feeding.

By Mr. Blain:

Q. For 20 years back a certain section of Ontario could not grow peas on account of this weevil, and they cannot grow them yet. In Bruce county they never had the weevil until three years ago, it seemed to be coming in. Nearly all through that section the year before there was a lot of Pea Weevil, and a great many dropped out of peas last year, but those that had them last year had no weevil at all. I was going to say that a few years ago I sent some peas that never had bugs in them down to Oxford county, they sowed them there and they found that year that they were full of the weevil?

A. Because you sent them to a district which was already infested, and the weevils from other fields flew to the one where your seed was sown, and laid their eggs on the young green pods.

Q. But they had never developed in our section in the county of Bruce?

A. No, the seed you sent was undoubtedly free of weevil—the infestation took place in Oxford county after your seed began to grow. There is a whole section where weevil may or may not develop, further south they are abundant every year. Unfortunately, the weevils develop most freely in the districts which are best suited for growing good peas. We seldom suffer from Pea Weevil in this locality, but if pea seed with the weevil in it is sent here to Ottawa they will develop here to a certain extent, but will soon die out.

Q. I do not think there was any weevil in that district, because we never had them there?

A. They can fly from other districts at a considerable distance.

By Mr. Cochrane:

Q. Supposing in our section of the country where we have not been growing pease, and where there is no weevil, if I fumigate the peas that I use, and the other people who sow them do not fumigate, would not the weevil from their crop injure mine?

A. Certainly, and that is why I want to get this matter before this committee, and through them to urge upon the general community that there is a practical remedy.

The difficulty is that everyone does not apply it. I want the people who are buying peas to say to pea growers: 'I will not pay you $1 per bushel for your peas when one-sixth of the feed value and five-sixths of the seed have been eaten away by the weevil, and when you can prevent the spread of the weevil by treating your seeds,' and to seedsmen: 'I won't pay you full price for pease of which only from 15 to 20 of every hundred will grow. You claim to sell good seed free from living weevils, and I will not buy your seeds unless they have been treated.'

Some seedmen fumigate their seed peas, but I found by talking to them that others say: 'I am quite willing to treat my seed if every one does so, but other firms do not do it, and I cannot afford to do so at extra expense and compete with them.' I believe the remedy is in the hands of the public, and my object in bringing this matter before the committee is that I may stir up such a fuss about it, that the people who are buying seed peas will do something. In 1902 and 1903 there was great loss from Pea Weevil attack, and much attention was drawn to the matter in reports, in newspapers and at farmers' institute meetings. Last year many seedsmen fumigated their seed, and if they will do so again systematically, we have a better opportunity than ever before to clean up our pea crop, and I want to make such a fuss about it now as to wake people up and make them wonder what it is all about; and if I can persuade them that they are paying one-sixth more for feed pease than they are worth, and five times as much for their seed peas, they may do something. I want the members of this committee to help me, because it is a matter of importance to a large part of the Dominion.

Remember that one-sixth at least of each seed is destroyed by the weevil and a percentage of five-sixths of the peas in a bushel are often rendered useless as seed.

By Mr Blain:

Q. How do you treat the pea seed?

A. There are two good methods of treatment. Bi-sulphide of carbon is now easily obtainable everywhere, you can get one pound for 15 cents, and three ounces of the liquid, costing a few cents, are enough to thoroughly clear 300 pounds of pease in an ordinary barrel. This treatment can be applied by everybody. The other treatment is to drench the seed with ordinary coal oil, using one gallon to 20 bushels of pease. Pour it over them a little at a time, and then shovel the peas over frequently several times, twice a day for three or four days. There is still another method which can be used successfully. If a farmer saves his own seed, and he knows they contain weevils, bag them up and keep them for two years before sowing. You see the weevil must come out the next spring after it develops in the green pease. The beetles cannot eat their way through the bags, and as they cannot feed on the dry peas they soon starve inside the bags, consequently you can sow these peas the following year and be sure that you are perfectly free from the weevil. The best time to treat the peas is directly after you have harvested and threshed them, because the injury to the seeds is less at that time than it will be later on.

By Mr. Henderson:

Q. How does the weevil get into the pea?

A. The eggs are laid on the green pods in the field, and the young grub eats its way into the pea while it is soft.

WEEDS.

By Mr. Maclaren:

Q. What about the ox-eye daisy? Is there any remedy for that? What success are you meeting with in the extermination of this and other weeds of a similar nature?—

A. To clean land of ox-eye daisies, seed down early with clover, cut your crop of clover early and you will destroy the daisies before the seed ripens. When you cut the second crop of clover you will again prevent daisy seed from ripening, and then when the clover is ploughed down the daisy roots are destroyed, because they grow close to the surface.

Q. What about the wild mustard?

A. There are two successful ways of treating this persistent enemy. Harrowing growing crops after they are well up with a light harrow or weeder or spraying the young plants before they blossom with sulphate of copper solution, using 10 lbs. to 50 gallons of water. This will kill all the mustard plants, but will not injure the grain among which they are growing.

Q. What about the Canadian thistle ?

A. The Canada thistle is a perennial plant which roots deeply; therefore, the secret is to plough deeply and keep harrowing or cultivating the tops down as soon as they show above ground. In this way the plant gradually becomes exhausted.

Q. Do you find that the farmers themselves are doing anything to exterminate these weeds?

A. Oh, yes. They are doing a splendid work throughout the country. I do not know any subject which is more interesting to farmers at meetings than that of noxious weeds, and I do not know of any line of study where better work is being done in this direction than through the fall exhibitions, the farmers' institutes and the agricultural papers.

By Mr. Cochrane:

Q. How do you say you get rid of daisies in the clover?

A. The ox-eye daisy flowers about the same time as the clover, therefore seed your land down with clover, cut your first crop before the daisy seeds are ripe, and when you cut the second crop you do the same thing again; then you plough up the sod and you destroy the ox-eye daisy, because it only grows on the surface and has no deep roots.

Q. But if the seed gets into the ground will it not lie there and germinate?

A. The seed of this plant is not like that of the wild mustard, which lies in the ground for a great many years and then germinates when a favourable time comes.

By Mr. Burrows:

Q. What about the French weed?

A. We do not recognize the name 'French' weed. Now, we speak of that old enemy as the 'stink' weed. Harrowing growing grain is the best way to destroy the young plants in crops. Early ploughing and frequent cultivation on summer fallows.

Wild Oats.—Some one asked about wild oats. It is generally known when land is infested with wild oats. The best treatment in my experience is to harrow or cultivate the land in the spring. Then sow it rather late with an early variety of oats or barley; cut these for hay when they come into flower; afterwards cut second crop and plough under.

By Mr. Christie:

Q. If you seed down for five years will that not finish the wild oats?

A. You mean seed down your land to grass.

Q. Yes.

A. I do not know whether the seeds of the wild oats would last in the land for five years or not, but I hardly think so.

Q. I do. I have lots of wild oats.

A. In what district, sir?

By Mr. Christie:

Q. I had a field of 20 acres in which many wild oats occurred. My experience is that you can get rid of them by allowing the field to remain five years in grass.

A. I do not think you will get many farmers who are ready to do that. I will ask the question of the gentleman from the West who asked about wild oats. Do you think there are many farmers in the West who would want to leave their fields in grass for five years?

By Mr. Maclaren:

Q. Does not the seed of wild mustard remain in the ground year after year?

A. Yes, it remains a great many years.

Q. Are the seeds carried back and forth by the manure?

A. They seldom get into manure, I think.

Q. It is liable to turn up years and years afterwards?

A. As much as twenty years afterwards.

Q. What about Perennial Sow thistle?

A. That is a very deep rooted perennial plant. It lives a great many years, and spreads widely by its running root-stocks, and also ripens great quantities of seed. The best method of eradication is to plough very deeply to destroy as much of the root-stock as possible. The best time to do that is just as it is coming into flower, if the land is not under crop at the time. If you are working the land to get rid of sow thistles it is a good plan to give up the whole year to summer fallow. The proper time to plough is at flowering time, because the plant is then in its weakest condition, having drawn off the largest amount of nourishment from the thick, fleshy root-stocks, but that alone is not enough—ploughing alone will not destroy this sow thistle. You will have to keep your land so cultivated during the rest of the year that the plant cannot get its leaves above the surface. The next season the land must be used for a hoed or cultivated crop—as potatoes, corn or roots.

By Mr. Wright (Muskoka):

Q. With regard to the ox-eye daisy, we have large stretches of country where they are spreading. Is there any method of killing them where the land cannot be cultivated?

A. The only method under such circumstances would be to turn sheep on the land to eat them, as these useful animals will eat daisies as well as many other troublesome weeds.

By Mr. Martin (Queen's):

Q. We have large quantities of wild tansy down in our country.

A. Where is that?

Q. Prince Edward Island.

A. Tansy is not as a rule a very bad weed, it generally grows along the edges of fields and roadsides. Is the plant the ordinary garden tansy with a yellow flower, finely cut up leaves and a strong odour?

Q. It is just like the common tansy.

A. A strong smell?

Q. Yes.

A. Tansy is a shallow-rooted perennial, with the roots near the surface of the soil.

Q. Propagates by the roots?

A. Yes, its roots do not grow very deeply, but they spread quickly, forming large patches.

Q. They grow on the surface?

A. Yes, the only way known to me is to break up the surface, and then cultivate till all the weed disappears.

By Mr. Herron:

Q. Is it impossible for good oats to degenerate into wild oats without having some wild oats seed to begin with?

A. The question has been very often asked. There is no doubt that cultivated oats were derived from wild oats, but it took a good many centuries to do it, with careful selection and crossing, and I do not think that cultivated oats would go back to wild oats except through a good many centuries of neglect, during which they would be more likely to die than degenerate.

Q. I am not positive, but I believe they are doing it.

A. I think uncertainty on this subject is chiefly owing to the fact that wild oats are very prevalent in some districts; experiments I have tried have never had the slightest effect in two or three generations. I have tried starving some plants and feeding others very heavily, all grown from the same seed. The wild oats were only affected in the size of the plants. There was no reduction or increase in the hairiness of the seed or in the size of the kernel. Similarly cultivated oats grown on very poor soil were only reduced in size. There are some kinds of oats which are very much like wild oats, Joanette for instance. What makes it seem unlikely to me that this rapid change takes place is that where it is supposed to occur in the west the soil is remarkably rich and instead of degeneration we should expect improvement. The winter would have no effect because oats very seldom go over the winter. There are certain characteristics by which wild oats may be recognized. These are most conspicuous in the seed. The kernel of the wild oat is exceedingly small, with a large hairy husk, and twisted awn. Another character is their earliness and the irregularity with which they ripen. Moreover we do not find any oats which have characters half way between wild oats and cultivated varieties. It is the opinion of botanists that cultivated oats do not change to wild ones. The Brackman and Kerr people of Edmonton are, I believe, trying some experiments now to see if they can answer this question.

PEA WEEVIL.

By Mr. Henderson :

Q. How do you think the reduction in the Pea Weevil is brought about—by farmers ceasing to sow peas or by this process which you described?

A. I do not think that the ceasing to grow peas had any effect whatever, nor is it a practical remedy. To be practicable, everybody without exception would have to cease; but in every district a certain number of people would grow peas in their gardens. Although an effort was made to persuade people to desist from sowing peas, I consider that such a thing is absolutely impossible. Neither the people of Canada nor of any other country are quite so generous or so much interested in the public weal that they are willing to give up a favourite vegetable like green peas for the benefit of any branch of trade, or for a class of the community that they are not specially interested in. Such a cessation of growing peas, to be effective, would have to be absolute, and not a single patch of peas grown anywhere in the area. I do claim that the fumigation did a lot of good. Owing to the intensity of the cold last winter and the cool, damp seasons which we have had for the last two years, we have now, as I have stated, fewer Pea Weevils in the country tah never before, as far as I know. The seedsmen will provide their customers with peas without the weevil if the farmers and others will only ask for them. Peas which have been weevilled will give only about 20 per cent of plants as seeds, and every weevilled seed has lost one-sixth of its bulk for feed. So that, if you buy weevilled peas you are paying one-sixth more than you ought to pay, and if you sow weevilled seed you may only get 2 per cent to grow, and you pay 100 per cent for them.

By Mr. Lewis :

Q. You said that you took a coal oil barrel to put the peas in in order to kill the weevil?

A. Yes. Put the peas into the barrel, pour in the liquid and then close the barrel tightly. Bisulphide of carbon is a liquid which volatilizes quickly at the ordinary temperature of the atmosphere, and the heavy vapour runs down among the peas in the barrel and kills quickly all insects which may be there.

Q. In reference to bagging up the peas for two years, would not the peas injured by the weevil be destroyed for seed?

A. They would, but the weevil would be safe in the bag, and any peas not injured would be just as good for seed in the second season as they were the first spring. There seems to be no appreciable decrease in the value of peas for two or three years for seed.

Q. Will bagging prevent the weevils coming out? What kind of bags?

A. Any kind of bags, even paper bags would prevent their escape.

Q. An ordinary sack will not do?

A. Yes, it will; they are unable to get through it, even a coarse sack.

By Mr. Henderson :

Q. I do not understand if the weevil gets into the pea when it is in its green state—

A. Yes, it does as a grub, and remains there till the next year, when it goes back to the field full grown, if you sow peas containing the beetles. The egg is laid in June, the grub hatches and lives inside the green pea, it becomes mature by August; occasionally some leave the peas in autumn, but most go through the winter inside the peas. When the peas are sown in the spring the weevils are carried to the field with them. A few days after they eat their way out of the seed pea and remain in the field feeding on the foliage of the young peas until the young pods are formed in June, when they lay their eggs on them, and the old beetles then die.

CHESS.

Q. Is chess in wheat produced by sowing chess?

A. Yes.

Q. And not from sowing good wheat ?

A. No. I found a great deal of difficulty in persuading some of the visitors to the Experimental Farm that chess can in no way come from wheat, until I hit on this device which has been very convincing to those who see it. I sow every year several rows of chess, and by the side of these I sow several rows of fall wheat. When visiting the grass beds farmers frequently discuss this supposed relation between fall wheat and chess and some hold very positive opinions. When the discussion has gone far enough I generally say: 'Now then, gentlemen, you all know what a grain of wheat is like,' and they all admit they do. I then take them to these plots and we dig up some plants of chess and some of wheat; both being grasses, the old seeds remain attached to the roots for some time, and in every instance you can find the seed of the chess plant attached to the roots, and as it is entirely different in appearance from the wheat, having a husk on it bearing several conspicuous bristles; those who see it are generally somewhat shaken in their faith, and many are convinced.

By Mr. Jackson (Elgin) :

Q. How do you account for having chess on new land that has never had any crop on it, where perfectly clean seed was sown, and where there has been a heavy crop there is none?

A. I cannot account for it, unless you allow me to say that it was 'apparently' perfectly clean seed that was sown. I had an experience in the North-west, and I merely relate it in order to point to the fact that it is hard to recognize the presence of foreign seeds sometimes. I went through the Prince Albert district two or three years ago, and there was a weed very prevalent there—the ball mustard. We collected samples of wheat from 27 farmers who had some of their seed left over. We took small samples from each, and in every case we asked them this question: 'Did you sow clean grain in the spring?' And the answer in every case was very positively, 'Yes.' We made an examination of those samples, and out of the 27 we found that 20 of them had seed of the ball mustard in it, but they did not know it. The reason is that the seed is like a small grain or particle of earth, and it had been overlooked when examining the wheat seed, probably under the impression that it was a small lump of earth. It is absolutely impossible for any treatment of wheat to turn it into chess, which is a different and distinct grass, not even closely related to wheat.

Q. In this section I speak of ,two years ago I opened up some new land with clean seed, and expected to get a good crop of wheat and that the result would be satisfactory.

Last spring the wheat winter-killed around the edges where the snow was lying on the top, but in the centre of the field there was a heavy crop. There was no chess at all in the centre where the wheat was good, but around the edge it was three-quarters chess?

A. I cannot account for it.

Q. Neither can I. That field had been in pasture and had never had a crop on it before; it had been in pasture for over 30 years?

A. Well, you see, in pasturing that land the stock that fed in there might have been feeding before on chess. I have carried on these experiments with chess and wheat for 15 years, and have never been able to produce chess from fall wheat by any treatment such as any of those which are supposed to produce it in the field. I can give no further explanation than that. If you have any fall wheat this year I would like to try the experiment that I have referred to of digging up some of the plants carefully as soon as you can recognize them as chess, and I am sure you will find that I am correct.

By Mr. Henderson :

Q. Have you not observed that in a crop of wheat where the fall wheat has been winter-killed chess comes up frequently?

A. Yes, and in my experimental plot where I plant year after year in one bed 100 grains of chess and 100 of wheat alongside each other, there is never any of the chess missing, while from 25 to 30 per cent of the wheat is killed out by the winter. The chess is much hardier than the wheat, and that is the reason it is more conspicuous where the wheat has been killed out. It stools out more, having more room.

By Mr. Jackson (Elgin) :

Q. You make the statement that it is practically impossible for chess to grow from wheat?

A. I do—and I challenge the whole world to disprove it.

Q. You will find that it is pretty hard to make some of us who have experience on our farms agree with you on that. As a matter of fact, I have been a farmer all my lifetime, and I have raised wheat on ground, taking it from the virgin soil, and sowed pure wheat, no chess in it whatever, I venture to say, and it produced chess, not where the wheat grew vigorously like, but where it was killed, or almost killed, out; in low places and around fences we would have lots of chess. As a matter of fact, some years with us we have sowed pure wheat and reaped almost the whole crop of chess, simply because the fall wheat has been killed out—I am speaking of fall wheat?

A. I know it is very difficult to believe, but I think if you will try that experiment next year and dig the plant up, you will be convinced. Now, sir, I am not trying to persuade you. I want you to examine the matter for yourself, and you will do me the greatest favour in the world if you will disbelieve what I say until you find out for yourself.

Q. I cannot believe it, you know.

A. I am delighted to hear it; the man who always agrees with you does not do you or himself any good, but I am so confident that chess comes only from its own seed that I want you to try and prove this for yourself. I am so sure that I will gladly stake the reputation of my other work upon it, and if you find I am wrong in this you are at liberty to distrust all my other statements. I have investigated this for years, and I am quite confident that it is not within the power of human beings by any treatment to get a plant of chess to grow from a seed of wheat.

Q. You can come up to the township of Southwold and tell the farmers there who have been farming all their lifetime that you are correct, and they will say to you the same as I do, that they can scarcely believe it—unless they see it for themselves.

A. That is it, unless they see it, but every reasonable person will, I believe, be convinced if next year when the chess is growing in the wheat he will water the soil so as to make it soft and mellow, and then make the test by taking a spade and digging up the chess plant carefully and then examine the seed attached to the root, he will see the difference between the seeds at a glance.

Q. We have uniformly good crops of wheat in our district when we have no chess whatever, but in seasons where the wheat is almost entirely killed, or the plant is very weak, then you have chess, and where the wheat plant is strong there is no chess.

A. I know it is where the wheat is killed out it shows most. Your position is the one that is taken by thousands of farmers, but the question is one that I have been investigating for many years; I am so confident in the result of my investigation that I ask you to make the same test, because I think my investigation of that particular question has been a little more thorough—because it has been made with the special object of finding out the truth—than of most people who complain that their wheat is full of chess.

Q. I have heard farmers saying that they have had chess growing on the same stem as the wheat?

A. I have heard it, too, and I have publicly offered $1,000 to any one who will find me one single example. Some years ago the *Farmer's Advocate* published a picture of an ear of wheat with a spikelet of chess growing out of the side. They were very careful about it, however, and they asked a committee of scientific men to examine it and would not allow it to be touched until that committee met. If I remember rightly, Dr. William Saunders was one of the committee. During the course of the examination of the specimen one of the members of the committee bent the ear of wheat slightly and the spike of chess dropped out. It had merely been caught in the chaff of the wheat by accident and broken off the panicle of chess on which it grew.

By Mr. Lancaster:

Q. You said that the chess is allied to the wheat?

A. Yes, but not very nearly; they are both grasses.

Q. Chess is usually associated with wheat, is it not?

A. It can be grown with other crops and it can be grown alone without any crop at all. The only reason it is found in fall wheat more than in other crops is because they are both sown in the autumn and mature the next year. They are biennials and very few other crops than fall wheat are of this nature. Where winter oats are grown chess occurs with them.

Q. That is the explanation of that association of the two plants?

A. Yes.

By Mr. Blain:

Q. It will come up as a volunteer crop in the following year along with the hay?

A. Yes, if the seed is there; but it is not a long lived seed. The seed left in the ground, if it did not germinate the first year, would rot. I grow it every year simply to show it to farmers. However, it has special value for feed. In Oregon, and Washington State where it is grown for hay, particularly on alkaline land, it is worth $8 a ton where timothy is worth $10; so that it has considerable value as feed.

WILD CARROT.

By Mr. Christie:

Q. Have you had any knowledge of the wild carrot?

A. No, it does not grow here as a weed. It is merely the cultivated carrot which has run wild. It is a rather troublesome weed in western Ontario and in parts of the United States.

Q. In western Ontario?

A. Yes.

Q. There is a lot of it there.

A. It is an easy weed to get rid of. Being a biennial plant it only lives for two years, and if regularly mowed or fed off by sheep so that no seeds ripen it must soon disappear.

LOCO WEED.

By Mr. Herron:

Q. Have you any knowledge of the loco weed?

A. Yes, I have examined and studied it in the North-west for many years, but I have never seen a case of Canadian bred animals being locoed.

Q. It is supposed to exist in Alberta.

A. Yes, the loco weed is common all through the Territories and across Manitoba to the wooded country.

Q. I know herds of horses that are crazy for it.

Q. Were they not driven over the border from the south?

Q. No, raised in Canada.

A. Well, the loco weed is very abundant in Alberta and right through to Manitoba, but it is not nearly so injurious there as on the Montana ranges, where there is less vegetation. The only reason I can imagine why it is less injurious here is that we have more grass on the ranges, and our stock do not acquire the habit of eating it as they do farther to the south. The plants are easily seen on the prairies; the creamy white or light purple flowers stand up in a stiff bunch and are very seldom eaten by our stock except as a starvation food when there is no grass. Where there is little vegetation of other kinds I could understand our stock might get the habit of eating it. I have never seen our ranges so bare that the stock had to eat loco weed.

Q. I have been told of a herd of 700 animals that had been eating it?

A. Where was that?

Q. Between Old Man's River and Willow Creek, in the Porcupine Hills.

A. That is strange, for there is good prairie there and plenty of good grass.

Q. Yes, plenty. Is it a poisonous plant?

A. It is poisonous when stock get into the way of eating it. It is not poisonous in small quantities, but if once they get the taste for it they eat it and nothing else, and the characteristic madness develops. It is a member of the pea family, a curious family which contains many anomalies in the way of closely related plants, some of which are poisonous and others of the highest value as food.

Q. I suppose it is something like the opium to the Chinese or tobacco to the Canuck?

A. Well, it is more injurious than tobacco without its advantages.

Having read over the preceding transcript of my evidence, I find it correct.

JAMES FLETCHER,
Entomologist and Botanist of the Dominion Experimental Farms.

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